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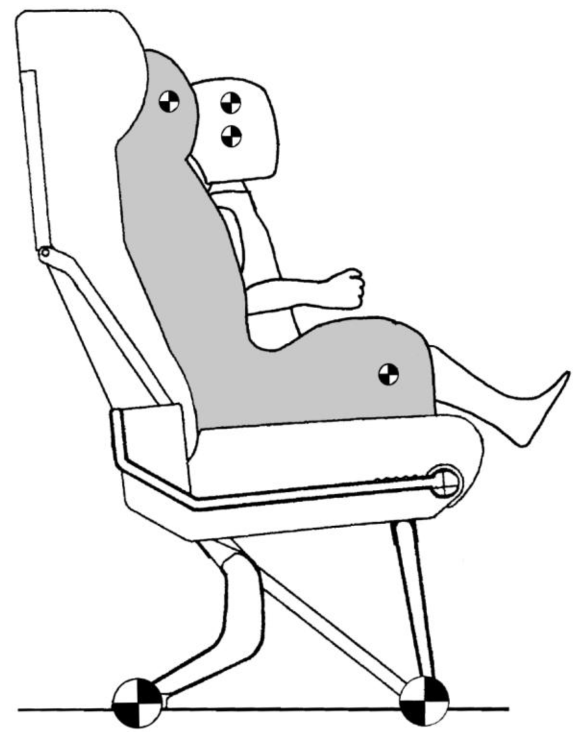
Child Restraint Systems in airplanes



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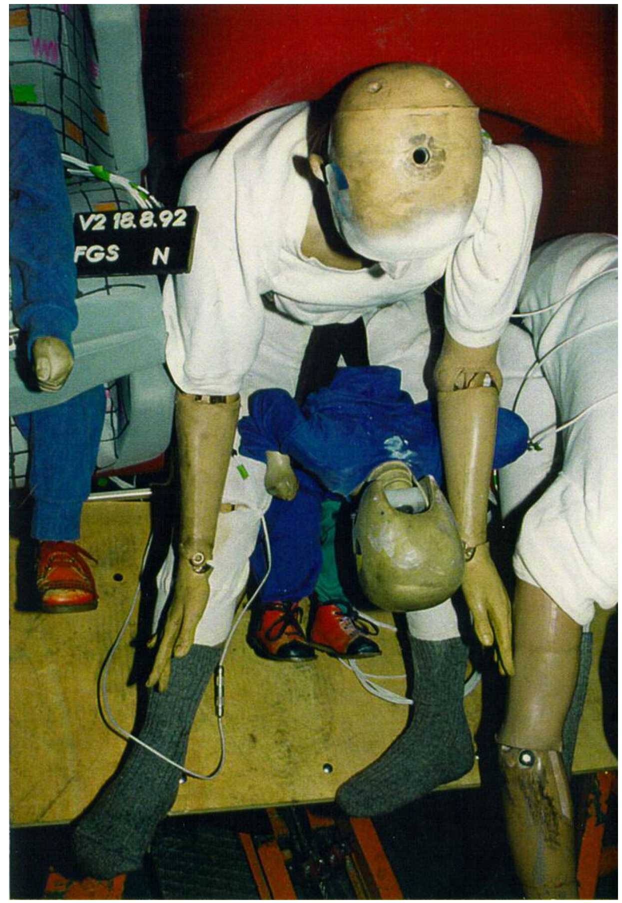
Restraint device “Loop-belt”

The baby is a very good energy absorption element for the adult

Loop-belt

After dynamic test,
5 % female dummy with a
baby dummy TNO P3/4 (9 month)

- The Loop-belt is going
through the abdomen -



Federal ministry of transport in Germany
Research work for the using of CRS in airplanes

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- Performing a literature research
- Opinion poll with parents / airlines
- Biomechanic
- Restraint - principles
- Installation tests
- Overturning tests
- Dynamic tests 16g
- Analysis of test results

Passenger Survey

Period of time :	July - September 1997 (Holiday time)
Airport :	Cologne/Bonn, Düsseldorf, Frankfurt
Number of parents :	365 Passengers
	73 % mothers
	23 % fathers
	4 % other persons

Travelling children aged up to 14 years : 537

If a seat for children under 2 years cost 50%, the consequences for the parents would be

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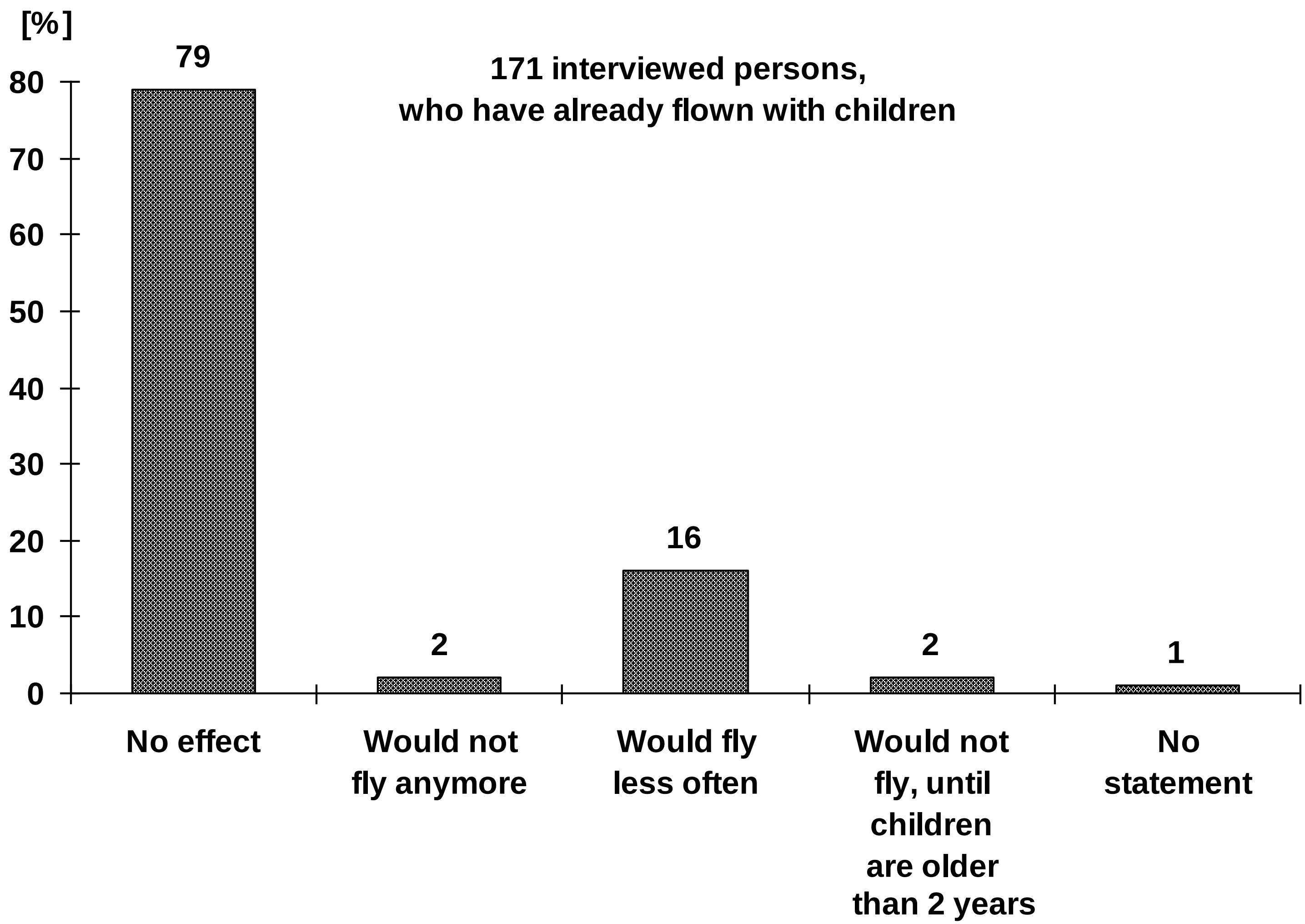
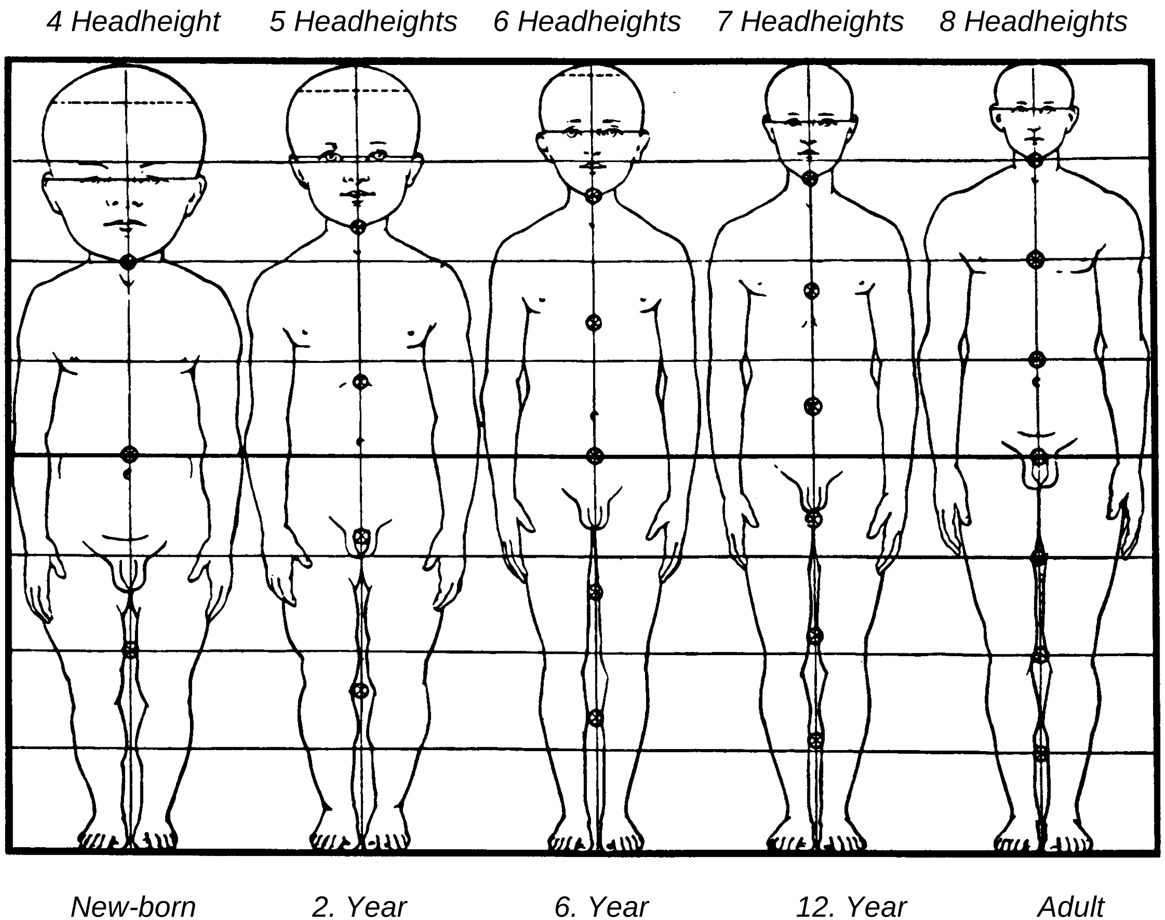


Biomechanic

- child evolution

- loading capacity

Bodyproportions during growth period



Loading Capacity

	Dummy protection criterions		Regulations
Head :	Head Injury Criterion Head acceleration	≤ 1000 ≤ 80 g t ≤ 3 ms	FMVS 213 ECE R 94; Directive 96/79/EC
Neck :	Vertical component of the acceleration from the chest towards the head	≤ 30g, t ≤ 3 ms	ECE R 44
Chest :	Chest acceleration:	≤ 60g, t ≤ 3 ms ≤ 55g, t ≤ 3 ms	FMVSS 213 ECE R 44
Abdomen :	No visible signs of penetration of the modelling clay, which is connected to the front of the Lumbar spinal column.		ECE R 44

Restraint principles for children

- Lap belt
- Front shield systems prop up against:
  - child seat
  - passenger seat
  - thighs of the child
  - thighs and a additional prop
- Restraint system with integrated seat belts:
  - rearward facing
  - forward facing
- Guiding of the lap belt

Fixing possibilities of CRS on the passenger seat

- Geometry of the CRS
- Lap belt
    - geometry
    - buckle
- ISO-FIX attachment
- Additional prop against the floor or the passenger seat

Installation Tests

- Test set up: two seat rows 28" seat pitch, two seater
- Selected seat: Seat A (Window)
- Put the CRS on the seat,
- fasten the CRS on the seat,
- put Dummy in the CRS (P ¾; P 3; P 6; P 10),
- fasten the Dummy in the CRS.
- Investigations with 12 different systems

Overturning Test

Dynamic Tests
16g forward, in accordance to SAE AS 8049a

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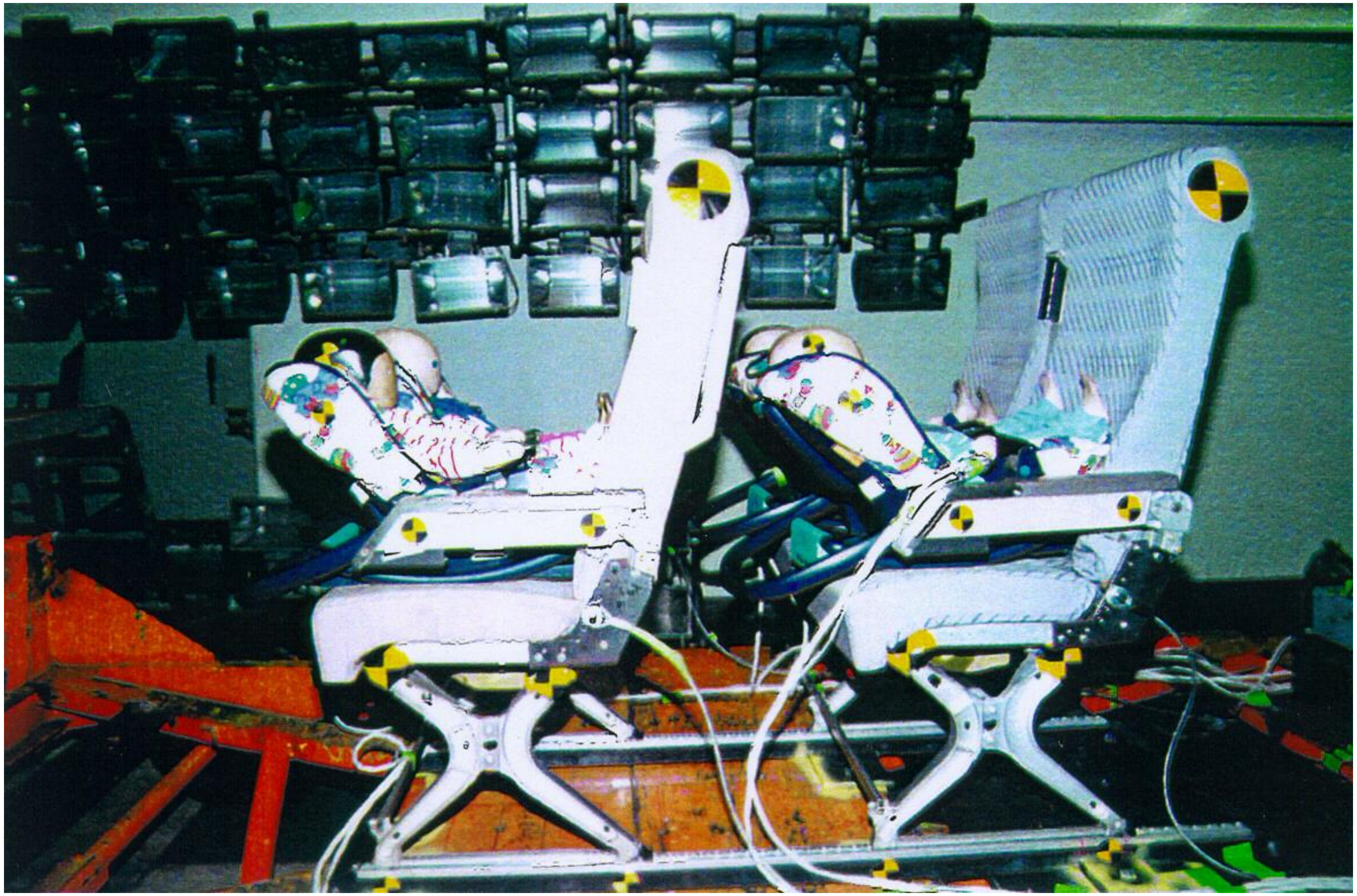
Child Restraint Systems for children up to 9kg (0; 0+):

Test Set up:	2 seat rows, 32" seat pitch
	2-seater
Number of CRS:	3 different types of CRS
Dummies:	4xP3/4
Number of Testsituations:	15

Child Restraint Systems for children from 9kg to 36kg (0-III):

Test Set up:	3 seats rows, 28" and 32" seat pitch
	2-seater
Number of CRS:	12 different types of CRS incl. ISOFIX
Dummies:	2xP3/4, 3xP3, 3xP6, 1xP10
Number of Testsituations:	24

Dynamic tests
Child Restraint Systems for children up to 9 kg



Dynamic tests

Child Restraint Systems for children up to 9 kg

Dynamic tests

Child Restraint Systems for children from 9 to 36 kg

Dynamic tests

Child Restraint Systems for children from 9 to 36 kg

ISOFIX

ISOFIX

The RÖMER ISOFIX-System

Innovative Design for increased Safety

The RÖMER ISOFIX-System:

According to a study by the HUK-Traffic Association (now GDV) approximately two-thirds of all child seats are installed incorrectly. Half of them so badly, that little protection is given.

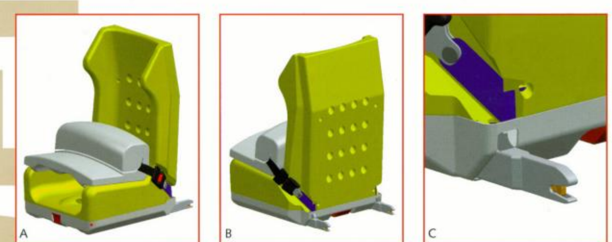
Awkward fastening systems and confusing installation instructions are "harder to understand than the city map of Tokyo" (Auto-Bild). The main problem, however, lies in the fact that it is often very difficult to install the child seat with the car seat belt.

Our solution is a special interface between car and child seat. A world-wide expert committee has agreed to a uniform standard for the child seat connection. **RÖMER** participated right from the beginning.

The **RÖMER "ISOFIX"-System** is a direct connection between child seat and car. Installation is via connectors, which are rigidly connected with the **ISOFIX** anchorages in the car (refer to figures A to C).

After locking both connectors the **RÖMER ISOFIX** child seat is firmly tensioned against the vehicle seat cushions. A secure and tight fit between child seat and car seat is achieved. In a crash, this gives the child a few – maybe crucial – extra centimetres of room for head forward movement.

Three-dimensional presentation of ISOFIX-seat on internal CAD computer system.



Click - tight - safe!

Fundamentals

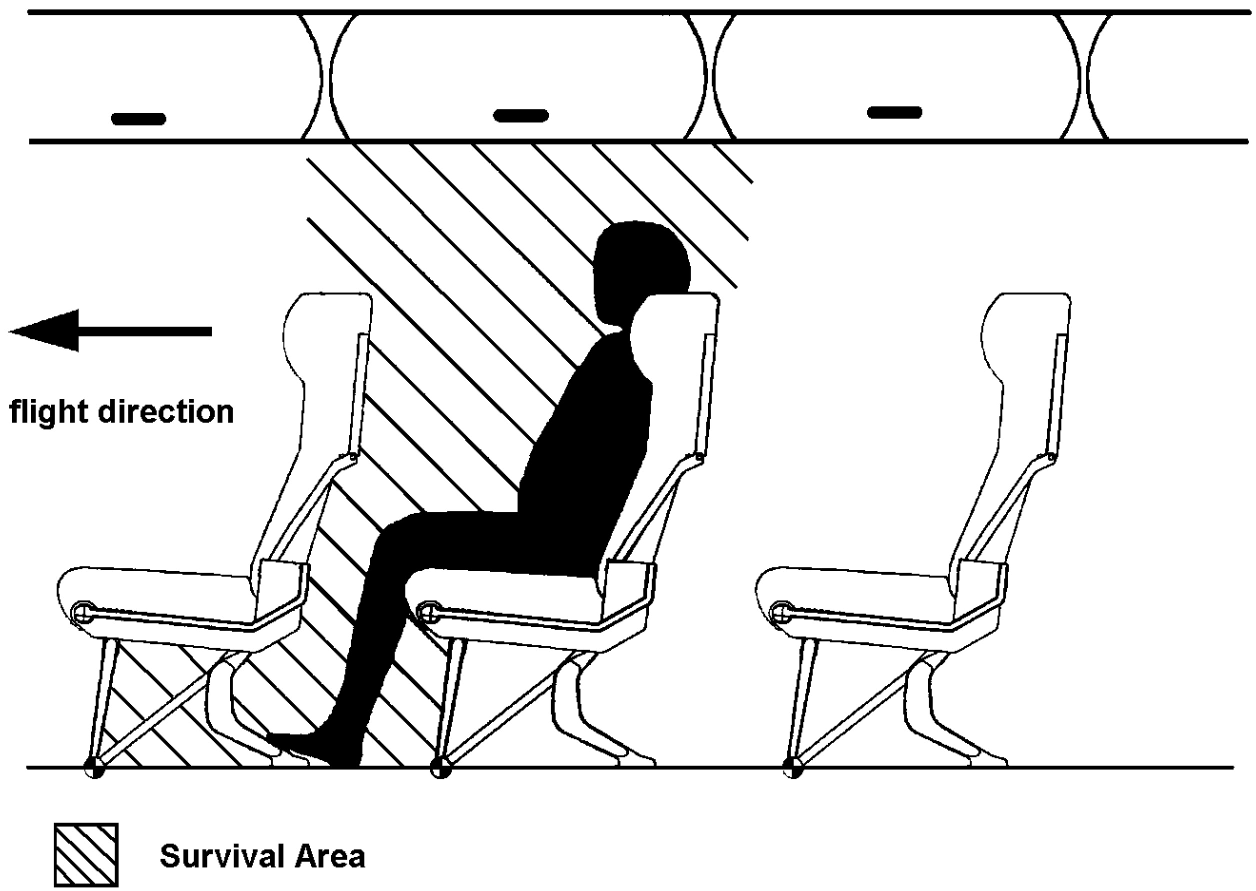
Suitable Requirements for child restraint system in aircraft

Restraint principles for children

CRD Fixing possibilities on the passenger seat

Biomechanics

Survival Area in an aircraft



Üraum.bmp

Equivalent safety for occupants

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- Each occupant must have an own survival area !
- Each occupant must have an own passenger seat !
- The same level of passive safety of all occupants !
- Children up to 7 years or 1,25 metre hights must use a suitable CRS !